U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-284 391

Symposium on Protecting the Marine Environment Research and Regulation

Environmental Research Lab, Gulf Breeze, Fla

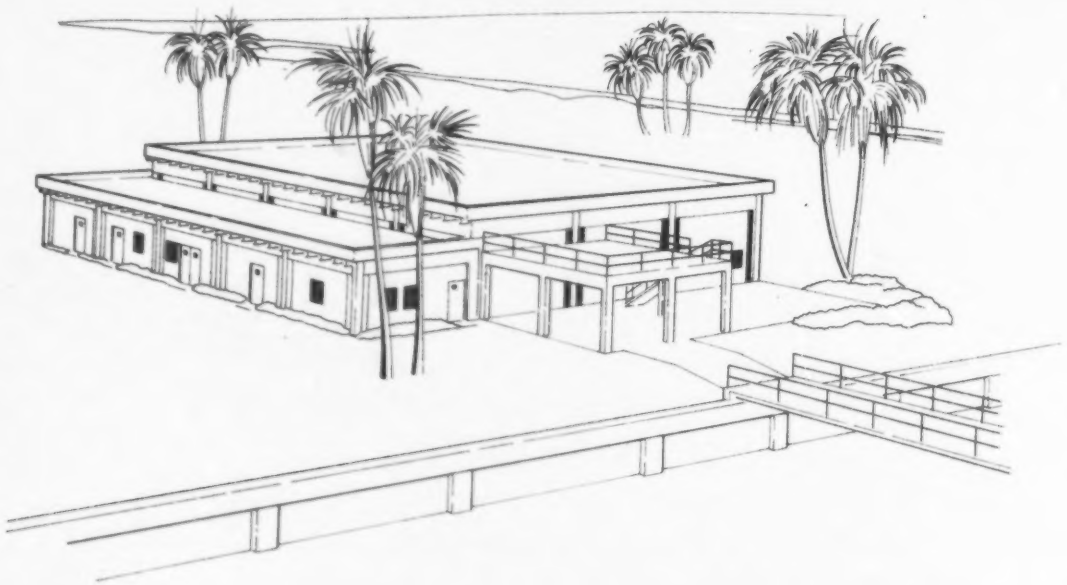
Apr 78

EPA-600/9-78-006
APRIL 1978

PB 284 391

SYMPOSIUM ON PROTECTING THE MARINE ENVIRONMENT

Research and Regulation



Sponsored by
Environmental Research Laboratory
U.S. Environmental Protection Agency
Office of Research and Development
Gulf Breeze, Florida 32561
October 7, 1977

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

The Environmental Protection Agency cordially invites
you to attend the
Dedication Ceremony of the
Marine Toxicology Facility and Symposium Entitled,
"Protecting the Marine Environment: Research and Regulation"
On October seventh nineteen hundred and seventy seven at
eight thirty 0'clock A.M.
Sabine Island, Gulf Breeze, Florida

R.S.V.P. Regrets Only

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA 600/9/78-006	2.	3. RECIPIENT'S ACCESSION NO. PB284391
4. TITLE AND SUBTITLE SYMPOSIUM ON PROTECTING THE MARINE ENVIRONMENT Research and Regulation		5. REPORT DATE April 1978 issuing date 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Betty P. Jackson, Editor		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Research Laboratory Office of Research and Development Gulf Breeze, Florida 32561		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Research Laboratory Office of Research and Development Gulf Breeze, Florida 32561		13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE EPA/600/04

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This symposium focuses on the essential role of research and regulatory agencies in protecting marine ecosystems. Purpose of the symposium is to commemorate dedication of a new toxicological test facility at the U.S. Environmental Protection Agency's Environmental Research Laboratory in Gulf Breeze, Florida, on October 7, 1977. Participants define the special function of the federal agency scientist, the social responsibility of the scientist, and the need for research in support of environmental regulation. Historical and future objectives of the Gulf Breeze Laboratory are also reviewed.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Toxicological Test Facility Ecological Research EPA, Environmental Research Laboratory Gulf Breeze, Florida 32561		

18. DISTRIBUTION STATEMENT Unlimited release	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 47
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE PC A03 MF A01

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

EPA-600/9-78-006
April 1978

SYMPOSIUM ON PROTECTING THE MARINE ENVIRONMENT
Research and Regulation

Betty P. Jackson, Editor
Office of the Director
Environmental Research Laboratory
Gulf Breeze, Florida 32561

ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
GULF BREEZE, FLORIDA 32561

DISCLAIMER

This report has been reviewed by the Gulf Breeze Environmental Research Laboratory, U.S. Enviromental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FOREWORD

Publication of the proceedings of this symposium commemorates the dedication of a new toxicological testing facility at the U.S. Environmental Protection Agency's (EPA) Environmental Research Laboratory (ERL) in Gulf Breeze, Florida.

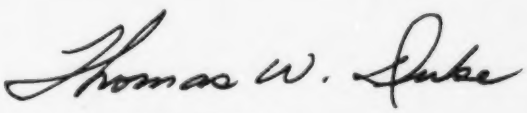
Completion of this laboratory facility exemplifies the EPA's effort to provide up-to-date scientific equipment and facilities required in its assigned mission to regulate production and use of chemicals and other pollutants that may have subtle, long-lasting effects on the environment and human health.

ERL-Gulf Breeze, one of 15 laboratories administered by ERA's Office of Research and Development, is staffed by a team of scientists representing nearly all regions of the United States and widely diverse disciplines dedicated to further understanding the marine environment. The principle laboratory, at Gulf Breeze, Florida, and its field station at Bears Bluff, South Carolina, provide EPA with its only Gulf Coast and South Atlantic laboratory sites.

Since 1956, ERL-Gulf Breeze has conducted research on effects of pesticides and other toxic organics on the marine environment. At the outset, experiments were accomplished using single species of marine animals maintained in standard aquaria.

More recently, researchers in Gulf Breeze have initiated new programs related to the environmental impact of off-shore drilling and the environmental acceptability of wastes from various manufacturing processes. Thus research objectives have broadened from toxicity tests with a single marine species to broader investigations in the area of environmental carcinogenic research. A major study underway at the Gulf Breeze Laboratory will assess the potential transfer of chemicals in the marine environment through the marine food web to man.

The new aquatic laboratory, offering increased capability for culturing and maintaining test species in flowing seawater, will aid Gulf Breeze researchers in understanding the effects of pollutants on marine animals and their natural environment.



Thomas W. Duke
Director
Environmental Research Laboratory
Gulf Breeze, Florida

ABSTRACT

This symposium focuses on the essential role of research and regulatory agencies in protecting marine ecosystems. Purpose of the symposium is to commemorate dedication of a new toxicological test facility at the U.S. Environmental Protection Agency's Environmental Research Laboratory in Gulf Breeze Florida, on October 7, 1977. Participants define the special function of the federal agency scientists, the social responsibility of the scientist, and the need for research in support of environmental regulation. Historical and future objectives of the Gulf Breeze Laboratory are also reviewed.

CONTENTS

Foreword iii

Abstract iv

Acknowledgements vi

Dedication Ceremony Remarks: New Direction in EPA Research 1

Dedicatory Address: A Focal Point for Studies of the Marine Environment 5

Dedicatory Address: A Pathway to a Stronger, Better America 9

Symposium Introduction 11

Protecting the Oceans (Peter C. H. Pritchard) 13

The Special Role of Federal Agency Scientists (John Clark) 16

Relationship Between Regulation and Research for Effective Protection of the Marine Environment (Sarah Chasis) 19

Of One-Armed Scientists, Short-Sighted Regulators, and Environmental Protection (Kenneth S. Kamlet) 23

The Social Responsibility of the Scientists (Robert M. Shealy) 28

The Need for Reasearch in Supporting Environmental Regulation (Robert V. Kriegel) 30

Homosapiens—Basic Researcher—Endangered Species (Alfred B. Chaet) 33

ACKNOWLEDGEMENTS

Photographs and illustrations for this publication were provided by Steve S. Foss, W. Allan Jackson, and J.A. Niland and Associates, Inc., of Pensacola, Florida.

EPA Laboratory Director Thomas W. Duke (center) watches as U.S. Rep. Robert L.F. Sikes and EPA Deputy Administrator Barbara Blum cut ribbon to open new toxicological test facilities at Gulf Breeze, Florida.

NEW DIRECTIONS IN EPA RESEARCH

Stephen J. Gage
Acting Assistant Administrator
Research and Development
U.S. Environmental Protection Agency
Washington, D. C.

I am delighted to be here today with Deputy Administrator Blum and Congressman Sikes to dedicate this beautiful environmental research facility. This, the Environmental Research Laboratory at Gulf Breeze, is one of fifteen laboratories operated nationwide by EPA's Office of Research and Development. As the person selected by Administrator Costle to be the next Assistant Administrator for Research and Development (ORD), I am extremely proud to oversee this impressive facility and, more importantly, its excellent scientific staff as part of my organization.

Although I've had only a few frantic weeks to think about my new job, I have confirmed some impressions I have been forming of the Office of Research and Development during my three years within the organization. I have also developed some new insights as I have begun working intimately with EPA's new management team and slowly learning what an awesome responsiblity the leadership of ORD entails. And I am happy to say that I am now cautiously optimistic that ORD can make very significant progress over the next few years. I should admit to you at this point that my experiences over the last three years have not uniformly suggested that ORD's sun was always rising.

Now, however, it's an exciting time to be in EPA. Not only is there a fresh capable management team headed by Doug Costle and Barbara Blum, there are also some important new currents flowing. These currents, not unlike spring tides, herald a new season for EPA and, in fact, for all environmental protection efforts.

The U.S. Congress, slightly less than one year ago, passed two critical acts--the Toxic Substances Control Act and the Resource Conservation and Recovery Act. The Toxic Substances Control Act, together with EPA's responsibility for regulating pesticides, has clearly placed EPA in the position of requiring toxicological testing of all chemical products before they are allowed on the market. The Agency's new mandate for solid waste management also emphasizes safe disposal of hazardous, toxic waste products from industrial processes.

Of equal significance, in my view, is the recent emphasis on reducing the release of toxic materials in air and water waste streams. Although the original thrust of both the Clean Air Act and the Federal Water Pollution Control Act was to protect human health and the environment from well-known, conventional pollutants, the Agency is now putting highest priority on getting toxic materials out of waste streams.

The upshot of these developments is that EPA is passing through a very important transition--one could say without much exaggeration--that the Agency is turning from the problems of the 60's to the problems of the 80's. I am very pleased to note, on this happy occasion, that the Gulf Breeze Laboratory has been one of the leaders within the Agency in bringing about this transition.

Since way back in the mid-1950's, Gulf Breeze has been studying the effects of pesticides and other toxic materials on marine organisms. While most of those early efforts seem primitive when compared to the sophisticated research you will see here today, those early results provided an invaluable basis for regulatory actions which EPA has taken to test estuarine and marine resources. The work has moved far

beyond establishing toxicity concentrations for individual pollutants on single species of animals in simple aquaria. With these new laboratory facilities, the Gulf Breeze scientists will be able to determine the effects of toxic pollutants on aquatic animals under conditions closely resembling those in the real world. Knowing how animals respond to pollutants in simulated ecosystems will give us a more accurate picture of how man's activities are disturbing the natural environments and will make our regulations much more realistic.

Considering the major contributions the Gulf Breeze Laboratory has made in helping us to understand the effects of DDT, chlordane, Endrin, PCB's, Kepone, and mirex on marine animals and to take regulatory actions on these substances, I have every expectation that the Gulf Breeze Laboratory will continue to lead the Agency in its important transition.

It's also an exciting time to be in the Office of Research and Development. It appears that we have a viable organizational structure, so we will not have to spend a lot of our time moving boxes around on an organizational chart. We can concentrate instead on doing our jobs and doing them better.

One new development which greatly pleases me is the rapidly growing recognition that ORD has two equally important functions--supporting the regulatory needs of the Agency's program offices and conducting long-term research to anticipate future environmental problems.

For the first time, the Agency is considering, as part of the Zero Base Budget review, establishing a new research category called "Anticipatory Research." Although the scope and size of this effort has not yet been fully defined, it is obviously an important new thrust for ORD. Many of us have keenly felt that we have an obligation to contribute to an improved understanding of environmental science and technology, but we have had precious little time and resources to dedicate to such long-term basic research. Now it appears that we will be able to commit part of our budget and, more importantly, part of our staff to the pursuit of research activities that can anticipate the problems of the 1980's and the solutions to those problems. This development is very heartening.

It is all the more critical then that we meet our other obligation--that of performing applied research in support of EPA's regulatory mandates--in a more timely, responsive manner. Research in support of regulation is ORD's raison d'etre. So, in this area, we must know unambiguously what we should be doing and who we're doing it for. This may sound like a meaningless truism, but it seems to me to be the life-or-death issue for ORD. Much of our research in support of regulation is, I'm sure, right on target. But I have a feeling, and some evidence, that a significant number of our efforts in this area are not focused on answering well-defined regulatory needs.

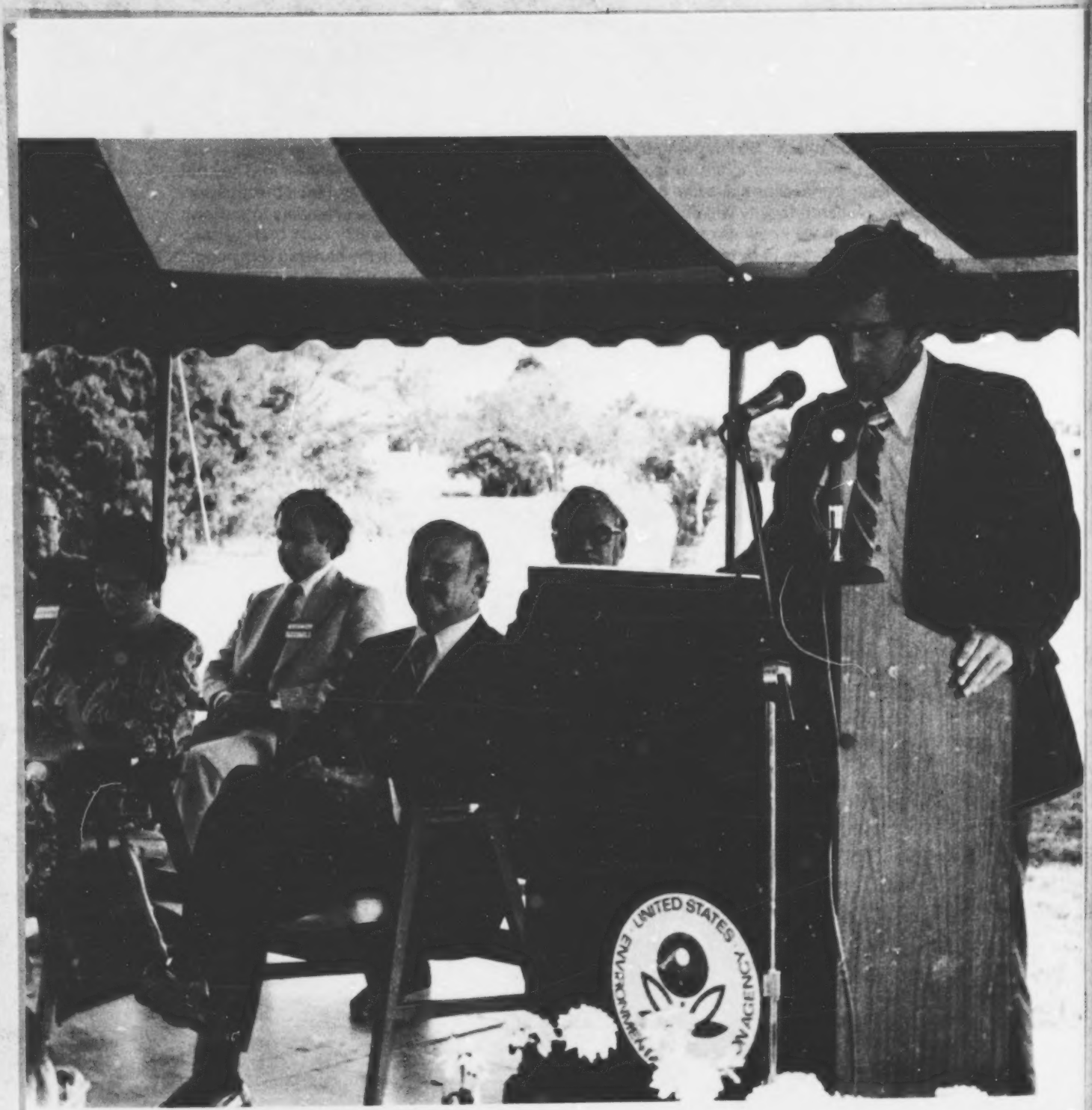
With the help of the Agency's new senior management team during the next few months, I will attempt to lay out a much clearer road map for both types of research efforts. More specifically, we will be attempting to determine:

- how the various parts of the research program relate to one another;
- how the research program relates to the rest of the agency; and
- how the research program relates to the rest of the scientific community.

Answers to these questions will give a much better idea of where we should be going. I am pleased that Dr. Duke will be serving on the policy-level panel so he can represent the laboratories' perspectives and help communicate the panel's findings back to the laboratories.

This is an excellent note on which to end my remarks today. Indelibly etched in my mind is the fact that people make the difference in any organization. I know there is no magical organizational formula which will solve all problems. For better or worse most organizations function, because of people and not

because of organizational form. So I'm going to put my money on people and ideas. Tom Duke, Tudor Davies, and the other Gulf Breeze scientists exemplify the type of people I'm going to invest in. They not only have the ideas, they have the skills and drive to make those ideas become reality. I trust that this new marine toxicology research facility will enhance the capability of the Gulf Breeze scientists to perform that special magic which we know as good scientific research. With the high quality work that I've seen coming out of the Gulf Breeze Laboratory during the last few years, I'm sure that my banking with people in this Laboratory will result in important dividends for the Agency and the nation.



EPA Assistant Administrator for Research and Development Stephen J. Gage reviews EPA research objectives in dedicatory address.

A FOCAL POINT FOR STUDIES OF THE MARINE ENVIRONMENT

Barbara Blum
Deputy Administrator
U.S. Environmental Protection Agency
Washington, D.C.

Dr. Duke, Congressman Sikes, distinguished guests, what a fine day this is for a dedication and a celebration. I certainly can see why we have so many people who want to work in this beautiful corner of the country.

Today we are here dedicating a facility which will be committed to fulfill EPA's mandate to conduct research on man's impact upon the marine environment. Dr. Gage--Steve--has told me about your significant contribution to the Kepone problem in the Chesapeake Bay and the specific ecosystem studies to model the fate of pollutants in estuaries. The quality of staff, the array of scientific capabilities, the conference facilities and the technical resources here bring together a focal point for EPA to concentrate on marine ecosystems. The studies, dealing with toxicity of pesticides, chemicals, and industrial wastes in the marine environment will provide a significant contribution to many critical issues currently facing the marine environment.

Under congressional mandate, the Environmental Protection Agency is delegated authority to regulate production and use of chemicals and other pollutants that may have subtle, long lasting effects on the environment and human health. Here at Gulf Breeze as Dr. Gage mentioned, the mission is to determine the effects of toxic organics on marine organisms and the ecosystems in which they live.

We are going to receive a full tour of your new and unique facility this afternoon, and I have already begun to understand why Tom Duke is one of our Agency's most respected scientists, not to mention one of the most gracious hosts.

I was also honored to meet our guests from the Soviet Union, Dr. Matveyev, and Professor Gorstko, and Dr. N.V. Butorin.

Gentlemen, on behalf of President Carter, with whom I talked earlier in the week, I extend a special welcome to you. Your participation in the Bilateral Agreements and your attendance here today are truly symbolic of the international importance of this laboratory.

As you know, the Administrator of the Environmental Protection Agency, Douglas Costle, is the United States Chairman of our Environmental Protection Agreement with the USSR. Other federal agencies--The Department of Transportation; the Department of Agriculture; Housing and Urban Development; Health, Education and Welfare; Agriculture; the President's Council on Environmental Quality; the Coast Guard; the Geological Survey; and the National Oceanic and Atmospheric Administration--also participate in this important bilateral agreement. EPA is the lead agency in 17 out of 41 of our mutual projects, and we are proud to be in the vanguard of the international environmental movement.

The nineteenth century philospher Goethe correctly observed that, "Art and Science belong to the whole world, and the barriers of nationality vanish before them."

I cannot think of many areas where this truism is more true than in the realm of the environmental sciences.

Because aquatic toxicology and analytical chemistry are of such paramount importance to the future of the globe, it is both fitting and proper that two of the world's most influential nations take a position of partnership and leadership.

It also seems appropriate that the estuary, the place where the rivers of the nations merge and mix and stir with the oceans of the world--the nursery bed for so many vital sea creatures--is also the cradle for such an important part of our growing understanding of the global nature of all environmental issues.

We are not merely dedicating a building here today. We are also paying tribute to an important set of symbols. A symbol of our national desire to learn and to explore the limitless realms of knowledge, and an example of America's desire to share our environmental science, and hopefully our environmental wisdom, with the caring people of every land.

We are not just cutting a ribbon here today, or breaking a bottle of champagne on the prow of a "Facility." We are, I believe, also recognizing the great contributions of the concerned citizens who have played such an important part in protecting the estuarine systems here on the Gulf.

As you may know, since much of it was written by, and/or about you, the Environmental Protection Agency's indepth assessment of the estuarine systems goes into great detail about the environmentally active residents of "the Panhandle." The fishermen, the homeowners, the garden clubs, the chambers of commerce, the conservationists, created a prototype for other concerned citizens all around the country. In the words of Thomas Hopkins, the author of the chapter on the public's participation here, "...citizen involvement has been effective even when it was isolated and unpopular, or smothered by red tape; citizen action has resulted in positive action which makes the outlook for effective preservation much brighter today than six years ago."

As Dr. Duke mentioned, I was involved in the grass roots environmental movement for a number of years and I know full well how many uncounted and unsung hours of effort and energy are required for any effective grass-roots campaign.

In this context, then, this lab is also dedicated to those people who helped to heighten public awareness and inspire government action back in time when it must have seemed as if no one else knew or cared.

Finally, we are here today to display our enthusiastic support to those men and women who will actually perform the research at this facility. To those environmental scientists who will be working here, let me say that I have had the honor and the opportunity of working with and for Jimmy Carter for over five years now, and I can say with a good deal of personal knowledge that he has always been proud to be considered an environmental leader, and he is always honored to be referred to as a scientist.

I can also say with equal fervor that neither the President nor any member of his Environmental Issues team has any desire to merely regulate or slow down the continued demise of America.

Our goals must be not only to help correct the dangerous environmental mistakes that have been made in the past, but more importantly, to honestly assess and effectively address the difficult environmental realities that confront our generation.

Jacques Cousteau, Thor Hyerdahl, and every other marine expert in the world knows that we simply cannot continue to consider the oceans as a bottomless pit. Every population planner and every sociologist knows that we are currently lagging behind in the race to make food production keep up with our exploding population's needs.

The work that will be done here at Gulf Breeze, your studies of the complex estuarine systems, the data base you will build, will not only be crucial in our short-term regulation and enforcement activities, but will also provide leaders all over the world with information that is so necessary if we are to be successful in the all important quest to protect our endangered oceans.

And when this day of celebration and dedication is done, and when the band goes home, and when you get back to the massive amounts of work that needs to be done, and when your eyes are red again from peering into those exotic microscopic worlds, then let me in my role as one-time behavioral, motivational scientist leave you with a suggestion.

Take a walk on the beach and stretch your body and your eyes and try to focus your mind on some far horizon. And think back upon this day of dedication and rededicate yourselves to the principles and the wisdom of Albert Einstein. Try to remember what he told his students back in the 1930's. He said, "It is not enough that you should understand about applied science in order that your work may increase man's blessings. Concern for man himself and his fate must always form the chief interest of all technical endeavors in order that the creations of our mind shall be a blessing and not a curse to mankind." Never forget this in the midst of your deliberations and studies.

Thank you.

ERL-Gulf Breeze Biologist Patrick W. Borthwick (left) and ERL-Gulf Breeze Laboratory Director Thomas W. Duke (center) describe new facilities for toxicity tests in flowing seawater to Steven R. Reznek, acting EPA Deputy Assistant for Energy, Minerals, and Industry, and EPA Deputy Administrator Barbara Blum and her daughter, Ragan.

PATHWAY TO A STRONGER, BETTER AMERICA

Representative Robert L.F. (Bob) Sikes
Member of Congress First District of Florida
Crestview, Florida

We are here to dedicate a new aquatic toxicological test facility. And if you don't understand what an aquatic toxicological test facility means--it means a million dollars. But more importantly, it is a major center for studying environmental effects of poisonous organics that include pesticides, chemical byproducts, and wastes.

We all know what a dead bay can be like; we are just getting over one. The work of this Laboratory also is concerned with this type of environmental problem. In addition, the Laboratory is concerned with the impact of oil drilling and the effects of oil spills. We know that also can happen here.

No area has more beautiful water and beaches than those found in the Gulf bays and estuaries. It is an area of exciting promise for those who love the outdoors; it offers promise also for commercial fisheries.

This Laboratory, the only U.S. Gulf Coast test facility investigating marine pollution, has been effectively administrated since 1968 by Dr. Thomas W. Duke, who directs an efficient and competent staff. Its island site is man-made, largely from ballast dumped by sailing ships anchored off an earlier quarantine station of the U.S. Public Health Service. That station was destroyed in the 1906 hurricane and was inactivated in the 1920's.

In 1937, the U.S. Fish and Wildlife Service established a shell-fish laboratory on the island. More recently, since 1962 the laboratory has been the center for pesticide research. In 1970, its administration was transferred from the U.S. Fish and Wildlife Service to the U.S. Environmental Protection Agency.

New and specialized space in the laboratory will reproduce the actual conditions of a marine ecosystem. Further, the new structure we are dedicating today will enable the laboratory staff to accomplish three times more work related to protecting and improving the great natural resources with which our nation has been blessed and which have been so needlessly wasted.

When we say we must protect the environment, we are not saying shut down the country. We can find, in facilities like this one, the pathway to a stronger and better America. We can find ways to improve, not thwart our economy.

Our resources are not inexhaustible. Here we can learn better how to conserve and utilize them.

I am saying that progress and environmental protection can and must go forward hand-in-hand, for the good of our land and the security of our people. In this spirit, it is with great pleasure that I join in the dedication of this needed facility. All around us is the Gulf Island National Seashore, which also represents the conservation of a priceless natural resource.

There are many ways to show our love and appreciation of America. We need them all. This much needed facility will help create a better America for tomorrow.

Symposium speaker, Dr. Peter C.H. Pritchard, urges domestic initiatives to improve the environmental quality of the oceans. ERL-Gulf Breeze Deputy Director Tudor T. Davies is seated at the speaker's table.

SYMPOSIUM INTRODUCTION

Tudor T. Davies
U.S. Environmental Protection Agency
Gulf Breeze, Florida

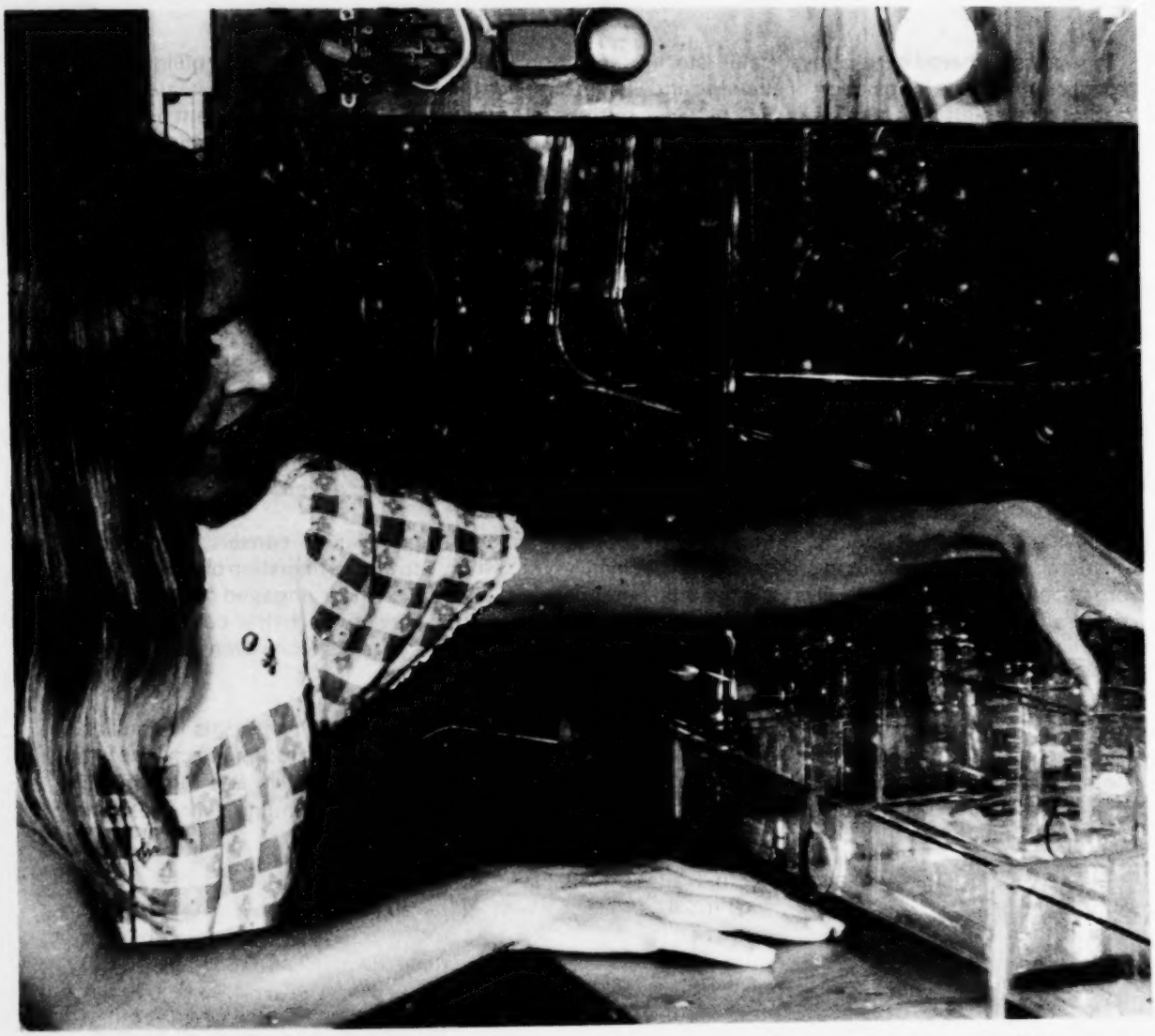
We are gathered here today to celebrate the dedication of our new research laboratory building. This event culminates a long period of planning and design, creative thinking, long hours of physical exertion, and dedicated effort. This new facility provides the laboratory with the physical environment necessary to provide research information to support the mission of the U.S. Environmental Protection Agency (EPA).

As with every celebration of achievements, it is necessary to evaluate their significance. As research scientists, we can look to our peers for evaluation of the strictly scientific merit of our work, and we are proud of our successes. But as research scientists, we have a very special perspective on the need for research and its obvious relevance to our agency's needs and the broader needs for protecting the marine and estuarine environment. We constantly must be aware that there are other perspectives on these research needs.

Today, to help us in a self-evaluation and perhaps rededication to the mission of the laboratory, we have as our guests a number of individuals who represent a wide range of perspectives. They will present their interpretation of the symposium theme, "Protecting the Marine Environment: Research and Regulation." These two approaches are not separate, but are closely interwoven.

We are delighted by the enthusiastic response from representatives of conservation groups, academia, and government invited to participate in this symposium. Strong participation of conservation organizations is required to give us a national perspective of the public who is engaged often as a non-professional in the struggle for environmental protection. I look forward to better communication between the participants today and in the future when we will not require a special event to hear each other's ideas.

We all require a significant public involvement in environmental protection. For this we must be involved in better informational exchange and marketing of our concepts. I expect today's decisions to be both entertaining and thought-provoking. It will give the laboratory a perspective and retrospective analysis of your ideas, and we hope that you will consider this symposium a continuing dialogue, rather than an isolated event.



ERL-Gulf Breeze Research Biologist Dana Beth Tyler-Schroeder arranges test containers for exposing grass shrimp (Palaemonetes pugio) to pollutants in new marine toxicological laboratory.

PROTECTING THE OCEANS

Peter C.H. Pritchard
Florida Audubon Society
Maitland, Florida

I am extremely happy and honored to be here today, representing the Audubon Societies at the celebration of the completion of this important new facility. I am particularly pleased that the new laboratory is an EPA facility. Many agencies are in the business of protecting the environment, but we of the citizen environmental movement very much look upon EPA as "our" agency; and since no agency can long survive without citizen constituents, we look upon ourselves as your constituents. This is a relationship that has never really become established with the National Oceanic and Atmospheric Administration (NOAA), or Interior, or the other Federal agencies with environmental responsibilities, principally because they have traditionally perceived their constituents as being those whom they regulated; and we have all seen, time and time again, how an agency with both promotional and regulatory responsibilities ultimately abrogates the latter, simply because if they become clearly identified with heavy regulation and only cursory promotion, their constituents would soon start applying pressure to have the whole outfit abolished.

But you, ladies and gentlemen of EPA, have no such internal conflict; you can regulate conscientiously because your constituents are not the regulatees, but the environmentalists; and if for good reason you make life uncomfortable for those who would prefer not to be regulated, you do not need their support because you will have ours, and we are now a voice on the national scene that cannot be ignored. If significant curtailment of the powers and functions of EPA, of 'our' agency, is ever proposed by the administration, the outraged shout that will arise from the environmental and conservation community will be so loud, that whoever made such an unwise proposal would be forced to retreat for his political life, doubtless assuring us that that wasn't really what he meant. You in EPA may not always think of yourselves as the spiritual sons and daugthers of Rachel Carson and the little old ladies in tennis shoes; but that you are, though your spiritual mothers might not always recognize you, now that you have figuratively gone to college and gotten into politics, and acquired a degree of technical sophistication, financial support, and influence that your spiritual mothers and fathers in the environmental movement never had. A very American success story, you might say.

The subject on hand today concerns the sea. Many agencies have responsibility for protecting the marine environment, and this is probably as it should be. There are some very good people in the National Marine Fisheries Service, and in the Coast Guard, and in Interior's Outer Continental Shelf (OCS) Office, and the Bureau of Coastal Zone Management. Protecting the ocean needs these diversified experts because the proper protection of the marine environment is, I believe, at least an order of magnitude more difficult than the protection of any other ecosystem. This is partly because the sea, to any given individual stress, is huge and forgiving, and it is this seeming invulnerability that has caused people to reserve their most noxious discharges and disposal problems and their worst and most careless petroleum-related accidents for the sea; and it goes without saying that river, land, and probably also air pollution ends up in the ocean. In fact, we have treated the ocean as a giant cess-pit while continuing to expect it to produce large quantities of uncontaminated food for us, and to provide our water-contact recreation without getting us dirty and giving us diseases. I think we can be impressed that it has done as well as it has. But the stresses we have imposed upon it are largely cumulative, and will be showing up more and more in the future, while conversely the benefits of clean-up efforts will similarly be apparent only very gradually and over many years.

In a sense, the protection of the ocean environment is an international problem. But I believe that we will not get very far if we put emphasis on international rather than domestic initiatives in trying to effect some improvement in the environmental quality of the ocean. And where we do become involved internationally, we will find it better to engage in cooperative efforts and treaties with other nations, taking only one or two at a time, rather than squandering our effort in attempts to reach global agreements with nations, many of whom simply do not think as we do about the sea or anything else. This is not to say that we should not participate in further Law of the Sea Conferences; perhaps we will be surprised and the mood of the international community may change. But I attended the 1974 Law of the Sea Conference in Caracas as a non-governmental representative, and was struck that the universal sentiment was 'what's in it for me' rather than 'how do we clean this thing up?' This was despite the fact that the head of the environmental caucus, if we can call it a caucus, was none other than Dr. Thor Heyerdahl, who proclaimed that we were all trying to divide the apple among ourselves without perceiving that it was already rotten, and becoming more so. Dr. Heyerdahl dramatically pinpointed the deteriorating state of the world's oceans by describing how he had seen no oil pollution on the ocean whatever during his rafting across the Pacific in the Kon Tiki in 1947, yet on the raft expeditions across the Atlantic in the 1960's, he had been surrounded by floating gobs of oil for almost the entire time he was at sea. We know that such oil pollution kills birds and makes the shoreline environment much less enjoyable for humans. We are only beginning to understand how seriously or permanently fish, mollusks, and other marine organisms are affected by oil. There is a growing body of evidence that marine turtles may suffer greatly from marine oil pollution, possibly in part by their habit of actually moving towards clumps of oil and attempting to ingest them. But out knowledge of the relative importance of this phenomenon is still in an embryonic stage.

There is much debate as to the best methods of controlling marine pollution. As I mentioned earlier, rather than seek impossible international agreements, the better option for the United States is simply to set unilateral standards that must apply to all ships and oil operations that have any impingement upon the U.S. market or shoreline. If we require that LORAN C and other sophisticated navigation devices are required on all tankers that enter U.S. ports, we shall get somewhere. It may sound ethnocentric, but we should also require that all tankers entering U.S. waters have an English-speaking captain or spokesman on board; at present, there are many ships entering our waters on which no one would understand a radio message from the Coast Guard even if he wanted to. The Coast Guard needs vastly increased funding to patrol the U.S. territorial waters, especially now that the economic zone has been extended to the 200-mile limit. It will also need funding to investigate unreported oil spills and 'fingerprint' the oil to establish the identity of the malefactor. We may also consider requiring tankers entering U.S. ports to have double bottoms or segregated ballast, or to have some genuine connection with the nation whose flag they fly, though these are controversial areas, and we should seek responsible industry input before implementing such proposals. Furthermore, since domestic offshore oil production is by its very nature less polluting of the marine environment than tanker traffic, we should not seek to block the responsible and adequately researched offering of offshore tracts to the oil industry for exploration. But we must not relent on the accumulation of data base for evaluating the effect of such operations on the marine environment, by adequately funded baseline studies, so that especially sensitive areas, particularly those adjacent to coral and other 'live bottom' areas, may be avoided.

While visible oil pollution is at least impossible to ignore, some other forms of marine pollution may be much more insidious. Oil on the surface is bad enough, but the sea may be like the young lady from Yap in the obscene limerick; the problem with this young lady, you may or may not recall, was that "...in her interstices, lurked a far worse disease." The vast spectrum of soluable pollutants in the ocean, although inoffensive to the eye, may indeed present a worse environmental infirmity that we can no longer afford to ignore. We must research and reevaluate our guidelines for ocean dumping and ocean sewer outfall. I do not call for mindless bans on these activities; there are certainly things the ocean, with its enormous volume, can dilute and biodegrade so that we are not bothered by them again. But our discharge points will require an intimate knowledge of currents, tides, and mixing patterns; and we must remember that many substances that we think we have diluted into oblivion may reappear in biologically accumulated form to haunt us much later. Heavy metallic ions--mercury especially--can be concentrated in animal tissue and pass their way up the food chain to accumulate to dangerous concentrations in the

bodies of high trophic food fish such as tuna. Chlorinated hydrocarbons, with their affinity for fat, enter marine food chains and bioaccumulate to the point that we can even detect their effects upon Antarctic penguins. Some of you, too, may be familiar with the research reported yesterday in the Miami Herald, which quoted Dr. Margaret James as estimating that it takes about 10 times as long for fish to expel common pollutants than it takes for a laboratory mouse; and that those who eat seafood instead of meat with the hope of avoiding an accumulation of carcinogens were in for some bad news. The heading of the item, "Fish Linked to Cancer," may have erred in the direction of overgeneralization. But it does point up the now recognized fact that the vast majority of human cancers are caused by foreign substances in the environment; and EPA's mandate to get a handle on this problem, undertake testing, and issue regulations that will protect people's health must surely rank, at the same time, as the most essential and overdue, and yet challenging, expensive and downright difficult direction ever given to a Federal agency. And since these toxic and carcinogenic substances always end up in the sea, it becomes the biggest marine environmental project ever undertaken. We of the citizen environmental movement will pledge our support and lobbying power for your adequate funding in this vast undertaking; we will also be increasingly involved in a public awareness program regarding environmental cancers. And I believe it behooves us to do the best we can to get the medical profession and the Cancer Society on our side, since heretofore these institutions have been more preoccupied with the perhaps hopeless task of cure rather than prevention.

I would like also to add a few words about marine exploitation, although this is not the primary purpose of EPA. Many people in many parts of the world depend on the ocean for an abundant and safe source of food; yet the tragedy of the commons is no more apparent than in marine fisheries, where every nation capable of mounting a fishing fleet has vastly overcapitalized in the pursuit of a diminishing resource. The shrimp harvest of the Gulf of Mexico could be brought home with probably one-third of the present fleet, and less incidental catch of marine turtles and other endangered species would take place if the fleet was so reduced. Of course jobs, mortgages, and other inescapable factors dictate that a large fleet be maintained; but in the long run we will all lose if we pursue each fishery resource to the point of collapse before we draw back and move to something else. Some of the most endangered species of the entire ocean are still being harvested by man, even the bowhead whale by Alaskans and the humpback whale by the West Indians; and we should never forget that species can be effectively destroyed, not just by habitat destruction, but also by the direct expedient of catching too many individuals. It is too often overlooked that, if we reduce a marine species to vanishing point by a directed fishery, other less desirable species may move into the ecological hiatus thus created, and the resulting competition may be such as to prevent any recovery of the depleted species even if we leave it alone henceforth.

THE SPECIAL ROLE OF FEDERAL AGENCY SCIENTISTS

John Clark
The Conservation Foundation
Washington, D.C. 20036

The record makes it clear that the level of environmental progress made in this country during the last 15 years would not have been possible without the efforts of the Federal scientific laboratories. Around the country Federal scientists have met the extraordinary demands of the environmental era with distinction. Here in Florida, Gulf Breeze has achieved a particularly distinguished record of accomplishment. We in the public interest groups recognize the work of this laboratory as an outstanding example of perceiving and performing the special tasks required of Federal agency science.

This special role is one subject of my address today. The other is the situation of the scientists themselves who work in the public interest.

In looking back, one sees that science has played a most important, and often dominant, role in the environmental revolution. It is a peculiarity of the environmental reform movement that scientists were often both its leaders and its heroes--Barry Commoner, Paul Erlich, Rachel Carson, and dozens more. These scientists not only brought on public awareness, but also provided basic ideology and helped to pattern the programs of change. This extent of scientific participation is unparalleled in the history of reform movements in the United States. Its legacy is a high demand by the public for continuing responsible scientific participation in the cause of environmental protection. This is not so easy.

A major difficulty is that the nation is not of one mind on environmental issues. Quite the opposite. Environment varies from a popular to a minority cause. A cause that however strongly supported by the general public is actively opposed by many special interests. Each major environmental gain has been in some way, a triumph of public interest alliance over a special interest opponent. The control of pesticides, the conservation of wetlands, the implementation of the National Environmental Policy Act (NEPA), the improvement of air quality, the legislation on toxic substances, the protection of endangered species, and most of our other environmental milestones were reached only after hard contests with politically dominant special interests who feared the interference of the public with their business practices. Scientists have played a critical role in these contests, a role that has profoundly affected the science trade and the public view of science.

Science has always had special methods for conducting its affairs and for assuring the credibility of its products. The different way in which science does its business results in a different mindset with scientists; so different in fact, that scientists are often uncomfortable in trying to work conjunctively with politicians or administrators. The exceptional few that can work comfortably in this context provide a crucial bridge between science and administrators.

Society's attempts to effect a working partnership between scientists and policymakers or administrators are often frustrated by differences of philosophy and problems of communication between the two disciplines. On one side, scientists may appear to administrators as incapable of grasping relevance, uninterested, independent, tedious, unable to deal with issues simply, incompatible with compromise, or irreconcilably divided in their interpretations and advice. On the other hand, administrators may appear to scientists as uncomprehending, over expectant, unable to express their needs, overly concerned with politics, or impatient and unappreciative of the rigors of the scientific method. This potential mutual disenchantment is a real world problem that must be faced by those dealing with scientists. To them I would give the following advice.

People outside science are often quite puzzled by scientists and by their eccentricities.

Scientists perform best under their own system. Science is motivated by a unique system of rewards that must be accomodated by its customers. They are scientists first, agency employees second. It is often difficult for administrators working with scientists to recognize the pervasiveness of this system and the effect it has on the willingness of scientists to engage in directed, or applied, work.

For example, success and advancement in the sciences is measured by publication, that is, the quantity, the quality, and the importance of research publications that the scientist produces. Publication, then, is the major reward befalling the efforts of the scientist. It follows that the opportunity to publish a credible scientific paper provides strong motivation and one that should be afforded scientists to the extent possible.

Scientists must be able to maintain peer approval, which is perhaps the strongest factor governing science. Each scientist must be allowed to work in a way that is consonant with the procedures, controls and approvals which science uses for its own governance. Lack of peer approval is a major setback for a scientist. Scientists should not be expected to perform tasks whereby they might suffer disapproval of the science community by the appearance of unprofessional conduct. A Federal scientist's accountability to the agency should be second to his, or her, accountability to the profession of science.

On the subject of the individual scientist's role, I will quote the opinions of Lee Loevinger, a lawyer:*

> We see a continually increasing need for scientific knowledge in policy-making institutions. Scientific data are clearly not only relevant but crucial to the consideration of many of our most pressing contemporary social problems. If scientists cannot become governors and remain scientists, how then are we to secure the input of science in government?
>
> It is the part of wisdom and maturity to recognize social problems as conflicts of interests and values to which science can contribute data and methodology, but which science cannot claim special authority to resolve. Scientists can show the public the means of defining the parameters of problems, the methods of investigating possible solutions, and the data that are relevant to the choice of solutions. Beyond this, scientists can offer interpretations, inferences, and implications from their data for the enlightenment of the public. However, their data and arguments will be accepted as scientific only if it is apparent that they were sought and offered in a truly scientific manner--that is, in a spirit of objective inquiry and not of advocacy. To put the matter most simply, scientists can best influence law and government by working as scientists.

I believe that is the spirit and tradition of Gulf Breeze--scientists working for the environmental cause by doing good, respectable, science. The results, brought to bear on critical environmental issues, have enabled EPA and the nation to accomplish significant change, often in the face of strong opposition.

A good example is the mirex fight in which Gulf Breeze scientists played the leading technical role in delineating the effects of this pesticide in ecosystems. Mirex exemplifies not only the best work and highest determination of EPA scientists but also the tenacity of opposition and the essential role of public interest organizations to bringing legal intervention in support of EPA.

On March 18, 1971, EPA issued a notice of intent to cancel registrations of pesticide products containing mirex because of evidence concerning its effects on humans and other animals. Allied Chemical Corporation, holder of 10 of the 11 mirex registrations, challenged the notice within a month. A

---

*Lee Loevinger. 1974. Jurimetrics: Science in Law. In: Scientists in the Legal System, Wm. A. Thomas, Ed. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan.

year later a Scientific Advisory Committee recommended continuance of mirex registrations with specific controls. Administrator Ruckelshaus accepted the findings of the Committee, concluding that while at that time the evidence of a threat to human health was not strong, there was distinct threat to the acquatic environment. Consequently, he banned application of mirex to all heavily forested and aquatic areas and prohibited aerial application in all coastal counties or parishes in July 1972 with modifications following in April 1973 to permit application to intermittent streams and certain ponds.

In order to resolve the issues still surrounding the use of mirex, the Administrator ordered a hearing to determine the future of mirex. Hearings began in July 1973 and continued unabated until March 28, 1975, when settlement negotiations commenced. These negotiations continued until July 14, 1975, when Allied Chemical Corporation announced if would no longer participate in the proceedings and threatened to stop producing mirex. The hearings resumed and proceeded until February 1976, when Allied stated its intention to abandon mirex. On May 10, 1976, the Mississippi Authority for control of fire ants announced that Allied transferred its mirex registrations to the Authority. More negotiations followed. Then in October 1976, EPA Administrator Russell Train approved a plan submitted by the Mississippi Authority for gradual phaseout of mirex registrations by June 1978, with interim controls. The hearings were suspended and Mr. Train's order was printed in the Federal Register on December 29, 1976, nearly six years from the beginning of the controversy.

The hearing record consists of over 200 exhibits and 13,000 pages of transcript and more than 100 witnesses were called to complete the action against a compound more persistent than DDT, with nearly unlimited capacity for accumulation in mammalian organs, with demonstrated carcinogenic attributes, with extreme toxicity to aquatic crustaceans, and with a proclivity to saturate the environment.

The amount of effort expended by EPA and other scientists toward resolving this one issue is almost incalculable. And it took much more than research. It took a commitment on the part of Dr. Duke and his colleagues of immense amounts of time and energy in interpretation and in preparation of testimony. It took considerable time to read and analyze opposing testimony and to work with lawyers and administrators in case preparation. It involved weeks and weeks of attendance at hearings and conferences.

Fortunately, most EPA scientists do not have to commit such amounts of effort to litigation and administrative proceedings, but some do and are called upon eventually for help in agency business. It takes a special sense of dedication for scientists to handle both roles.

The mirex incident is only one event. The polychlorinated biphenyls (PCB) issue is another whole story. There are stories about DDT, dieldrin, and many other research campaigns including the comprehensive study of Escambia Bay.

The future holds many new scientific challenges in the field of environmental protection. New biocides are still being developed. The new toxic substances control act greatly extends the range of EPA interests. While the industry is charged with testing new chemical products, someone has to keep the testers honest by spot checking and verifying their numbers. This is a crucial job that can be done only by laboratories such as Gulf Breeze.

In these issues, responsible agency science is the only hope the public has to stand up against powerful private interests with huge sums available for the purchase of science allied to their needs. As Ralph Nader has said: "Both the public interest groups and the independent scientists lack the resources...to respond rapidly to regulatory issues which require the application of scientific expertise."*

---

*Ralph Nader. 1974. Obligating Scientists to Respond to Society's Needs. In: Scientists in the Legal System. Wm. A. Thomas, Ed. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan.

RELATIONSHIP BETWEEN REGULATION AND RESEARCH FOR EFFECTIVE PROTECTION OF THE MARINE ENVIRONMENT

Sarah Chasis
Natural Resources Defense Council, Inc.
New York, New York

I am honored to have been asked to speak here today at the dedication of the new marine toxicology facility of EPA's Environmental Research Laboratory at Gulf Breeze. I have several reasons for being delighted to be here today. One is that I have warm associations with Pensacola because I have family living here. The second is that for people like me who are interested in coastal and marine ecosystems, this area with its system of estuaries, bays, and barrier islands constitutes a perfect example of the importance of our marine resources to recreation and to a healthy commercial fishery, and therefore serves to emphasize the value in protecting these resources.

Finally, I am pleased to be here since I was recently involved in litigation which demonstrated this laboratory's crucial role in the effort to reverse the pattern of destruction of marine resources. That was the litigation to halt the discharges of PCB's by General Electric into the Hudson River. Two scientists from this laboratory, Dr. DelWayne R. Nimmo and David J. Hansen, who along with several other scientists from Gulf Breeze Laboratory had studied the PCB problem in the Escambia River and Bay starting in 1969, presented crucial testimony on the persistence of PCB's in the marine environment and the acute and chronic toxicity of PCB's to marine organisms. Their testimony provided a key link in the chain of proof necessary to show that the discharges of PCB's by General Electric were injurious to the fishery resources of the Hudson River and therefore violated New York State law. The outcome of that case has been the cessation of the discharge of PCB's, and the expenditure by General Electric of $4 million to study the feasibility of a clean-up program to remove the contaminated river sediments.

Through the work of the EPA laboratory and the technical assistance provided by its scientists in regulatory actions, the long, sad history of the destruction of the marine environment is beginning to be turned around. This brings me to the topic I and the others have been asked to consider today, namely the relationship of regulation and research to the protection of the marine environment. The basic question I wish to address is how to enhance the relationship between these two prerequisites to effective marine protection.

There are three basic observations which I have with respect to this question. First, there needs to be better coordination of research goals with regulatory goals. Second, there is a grave need for independent and reliable research to be carried out by laboratories, such as this one, to assure that a sound and impartial basis for regulation exists. Third, there is a need for research to be properly directed so that it may provide the relevant answers at key points in the regulatory process. To illustrate these points, I would like to turn to three different regulatory programs which have had difficulty relating regulation to research and vice versa, with the result that protection of marine resources has suffered. The three programs are EPA's toxic substances control program, EPA's program to regulate the impacts of power plants on estuarine and marine organisms, and a program not run by EPA but which has the potential for seriously affecting marine resources. That is the OCS oil and gas drilling program. These programs are not alone in terms of the gaps which exist between research and regulation. They are chosen only as examples.

Because of this laboratory's highly regarded work relating to toxic substances such as PCB's, Kepone and mirex, and because control of the use and release of such substances into the marine environment is recognized as one of the most pressing health and environmental issues we face today, I

would like to address some of the problems that have plagued the relationship of research and regulation in the field of toxic substances control.

Since at least 1972 when the Federal Water Pollution Control Act was passed, the control of toxic chemicals has been recognized as a high priority. Yet there has been a serious problem in translating that legislative priority into effective regulation because of the lack of supporting research.

Under Section 307(a) of the Water Act, the EPA had 90 days from October 18, 1972, to prepare a list of toxic substances for which effluent standards were to be established. Environmentalists believed that section to apply to those highly toxic chemicals for which technology-based or economically based standards was inappropriate or insufficient. After initial litigation by environmentalists, EPA in July 1973 prepared a list of nine substances to be regulated under Section 307(a) of the Water Act. Most of the substances were pesticides, a few metal ions, and PCB's. At administrative hearings held by the EPA, the agency found itself swamped with technical information from affected industries that claimed that the agency did not have an adequate scientific basis for setting proposed effluent standards for these substances. Consequently, the EPA abandoned their proposed regulations regarding these nine substances and failed to promulgate final effluent standards under Section 307(a). It should be noted that it was in large part because of the lack of an existing PCB standard that General Electric, for example, was able to obtain from EPA in December 1974 a permit authorizing it to discharge up to 30 lbs/day of PCB's into the Hudson River.

This failure of EPA to vigorously pursue toxic substances regulation when it clearly possessed the legal authority to do so can be traced in large part to a lack of supporting data. Knowing or suspecting that certain substances should be regulated because of their toxicity and prevalence in the environment was not sufficient. EPA had to establish Section 307 standards based on careful and thorough research. Yet much of the necessary research had not been carried out. In fairness, researchers were faced with an impossible task in view of the host of chemicals which had invaded industrial and agricultural uses since World War II. As a result, EPA was unprepared to carry its burden of proof. And the manner of regulation of toxic substances had to be rethought.

Only recently, after years of litigation between EPA and environmentalists, has a comprehensive federal toxic pollutant control program finally been established: 129 toxic pollutants have been listed in a settlement agreement as priority substances for which EPA is to establish standards. The selection of the 129 substances was based on a prioritizing of chemicals in terms of their potential harm to the environment and public health. This was determined on the basis of existing knowledge concerning chemical persistence, manner of transport in the environment, bioconcentration and biomagnification factors, synergistic and cumulative effects of the chemical substances. The standards to be established, however, rather than being based on the Section 307 criteria, which include toxicity, persistence, degradability, presence, and importance of affected organisms, will be based on the levels that may be achieved by application of the "best available technology" (BAT). The standards are thus technology-based. A key provision of the settlement agreement, however, requires EPA to apply even more stringent limitation on discharges where the technology-based limitations are inadequate to achieve, or maintain, the Water Act's 1983 fishable and swimmable water quality standards.

Thus we see that the regulatory strategy for toxic substances control has been adjusted to the lack of relevant toxicity data upon which to base effluent limitations and instead places reliance in the short term on technology-related standards which can be determined with greater certainty and which will be less vulnerable to legal challenge. It is essential, however, that the research on toxicity, persistence, degradability of these 129 chemicals and other chemicals suspected of being toxic be carried out on a priority basis to determine if, in fact, the technology-based controls are sufficient. There is thus a pressing need for laboratories such as this to have the opportunity through full staffing and funding to study and screen the 129 compounds, as well as other toxic substances, on a top priority basis.

In addition to closing the enormous gaps in the understanding of the prevalence and effects of compounds already in use, scientists at this laboratory also have an important role to play in helping to formulate generic guidelines for the premarket testing of new chemicals, a requirement imposed under the recently enacted Toxic Substance Control Act. Rather than allowing testing to occur on an ad hoc basis, EPA scientists, industry and public interest groups must work to develop generic guidelines and meaningful test protocols which must be adhered to.

I have spent a good deal of time discussing research and regulatory issues related to toxic substances control. I would like now to turn to two other regulatory programs which reveal other ways in which the relationship between research and regulation needs to be enhanced in the field of marine protection.

The first of these programs involves EPA's regulation of utilities under the Federal Water Pollution Control Act, in particular the control of thermal effluents and the intake of large volumes of cooling water which results in the entrapment and entrainment of fish. The reason for concern about this program in the context of today's discussion arises from the fact that it points up a generic question which is whether or not there can be effective regulation where the basis for regulation rests exclusively on research conducted by the affected industry. This program is not atypical. The issue is also faced in other contexts. Under NEPA, for example, an important issue has been who should collect the data upon which the Environmental Impact Statement is based.

In case after case, we have seen utilities come in with huge volumes of data in support of their position that there is no significant impact resulting from operation of their particular plant. No adequate quality control procedures govern the collection of this data, so that EPA is often forced to reach a decision regarding the predicted level of impact on a marine species based on admittedly poor data. This recently happened in connection with the decision of the EPA Administrator regarding the Seabrook plant in New Hampshire.

On the Hudson River, we see several utilities expending over $15 million to collect and analyze data concerning the aquatic resources of the Hudson River and the impacts of power plant operation on these resources. The utilities choose and contract with the consultants who perform the data collection and analysis. It is then this data base which will form the basis for the agency's regulatory decision. The potential for bias, as well as the lack of assurance that a sound, reliable data base will be produced on which to make a decision, makes the present set-up extremely unsatisfactory.

Government scientists as well as experts working for environmental groups must spend inordinate amounts of time examining the industry-collected data, reviewing the numerous steps performed from the collection stage to the final conclusions. Frequently, it is like pulling teeth to determine how and why certain sets of data have been eliminated in the process. No one knows this torture better than my colleague, John Clark, who has served as an expert witness for environmental groups in a number of power plant cases. Many of the EPA scientists from laboratories at Corvallis and Narragansett have played invaluable roles in these proceedings and can also testify to the frustrations associated with working with the utilities' data base.

I think that there must be changes in who controls the data collection. To guard against the dangers of bias, I would favor one of two alternatives: government agencies themselves, utilizing laboratories such as this, should conduct their own research which can provide a supplementary or alternative data base to that of industry on certain key issues (I am not suggesting on every issue); in the alternative, the government agencies should choose the consultant who gathers the data, with the consultant answering to the agency rather than the industry. Also, there is the possibility of government agencies, with the advice of experts, establishing acceptable lab and field testing practices--the Federal Drug Administration (FDA) does this.

The last program I would like to discuss is the Department of the Interior's (DOI) offshore oil and gas leasing program. This program points up the uselessness of research unless it is directed towards

answering the relevant questions at a timely juncture in the regulatory process. The DOI through NOAA and various other Federal agencies and private contractors is conducting an environmental baseline studies program at a cost of $50 million annually. The program is ostensibly designed to provide data and information relevant to decisions about where to lease and under what conditions. Yet the design of this research program is such that it will not provide answers when they are needed and will be, therefore, of minimal value in furthering marine resource protection.

The purpose of the research effort to date has been to inventory marine species in the leasing areas prior to and then subsequent to the occurrence of development and production activities, with the idea of comparing these sets of data and thus assessing the effects of OCS activities on the marine environment. An obvious problem with such an approach is that the impacts of OCS activities are discovered, if at all, only when it is already too late to do anything about the effects. The damage has already occurred. In addition, development and production rights to private companies, will have already occurred. Thus no matter what the research may show, its utility in the decisionmaking process will, of necessity, be slight.

Furthermore, baseline environmental studies cannot be counted on to indicate even as much as 20 to 30% shifts in marine or coastal populations resulting from OCS operations. Such studies are often not able to measure even 100% shifts in populations with any degree of reliability. Nor do they get at the causes of the shifts which do occur. We have seen this problem dramatically illustrated, in more limited environments such as estuarine systems, in connection with some of the studies referred to above which have fisheries. The same before-and-after approach has been tried. The confidence limits placed on the population estimates in these studies and the fluctuations in populations occurring from natural causes are so great, however, that it is almost impossible to isolate the relationship of the power plants to these variations and quantify the adverse effects. The same problems appertain on an even greater scale to baseline studies conducted on the OCS.

For these reasons we have recommended that the environmental studies program concentrate on a more predictive approach that involves analyzing the natural systems and processes which may be affected by OCS-related activities and predicting the impacts OCS activities may have on the operation of these systems. If specific research projects are developed to study the processes of the natural systems which may be affected and the kind of effects OCS activities may have on these processes, the environmental studies program would become a more useful tool for decision-making. In addition, the quality of scientific interest would be higher in such projects, as contrasted with projects which involve merely inventorying of resources.

This concludes my discussion of the three basic ways in which I see the relationship between research and regulation may be enhanced to further the goals of marine resource protection. Before ending, I wish to point out that there are two very heartening facts about today's dedication ceremony. First, the new marine toxicology facility means that the scientists at this laboratory who have already contributed so much to the understanding and control of pesticide and toxic substance pollution will have the opportunity to conduct more work than before under improved conditions. I hope that this is a sign of central EPA's increasing commitment to toxic substance control. The other heartening feature of today's event is that you have asked people like myself of the environmental community to come and speak about their perceptions on this important subject. While you may not always like or agree with what we say, I believe that this opportunity will serve to increase the cooperation between us, which is important if we are to achieve our mutually shared goals.

OF ONE-ARMED SCIENTISTS, SHORT-SIGHTED REGULATORS, AND ENVIRONMENTAL PROTECTION

Kenneth S. Kamlet
National Wildlife Federation
Washington, D.C.

It is a great pleasure and honor to have been asked to participate in this Marine Research Symposium and in the dedication of the Laboratory's new marine toxicology facility. The linkage of the symposium on research and regulation to the dedication is very apt, because protecting the marine environment requires both adequate technology and facility support and the systematic ability to apply research to the solution of regulatory problems.

In preparing these remarks, two metaphors come to mind. The first is the apocryphal reference to the one-armed scientist as something we need more of. Why one-armed? Because of the common view of scientist as following every statement with a sentence beginning with the phrase "on the other hand..." I guess lawyers are guilty of that too sometimes. As both a lawyer and a scientist, I suppose I have both arms amputated.

The other metaphor comes courtesy of the comic strip, "Freddy." It seems that Freddy, in the course of collecting fallen leaves in his backyard, had a brillant idea for disposing of them. He proudly proclaimed what he called his "terrific new sign-tiff-ic theory" for getting rid of trash. You simply toss it into the wind and let the breezes carry it away without a trace. In my work at the National Wildlife Federation, I am often reminded of this comic strip. It seems as though every day someone comes up with a great "new" way to dispose of wastes, such as tall smokestacks for power plant emissions, and fancy outfall pipes and diffusers to make a whole host of liquid effluents vanish miraculously into the ocean, "without a trace."

That is why the research that goes on at laboratories such as this is so terribly important. It allows scientists and lawyers to make tough decisions without being torn between Hamlet-ian alternatives. And it makes it easier to overcome the logic of the Freddys of this world who think that what we can't see and don't know can't possibly hurt us.

Let me tell you something about the National Wildlife Federation--what we are and what we're all about; then I'd like to share some thoughts with you on the topic of this symposium: the interrelationship of research and regulation as they bear on protection of the marine environment.

The National Wildlife Federation (NWF) was born just over 40 years ago, in the midst of the Great Depression, at a time when conservation was such a low national priority that it was compared to a "bowlegged girl," shunned by suitors. The Federation nearly went broke embracing the "bowlegged girl" before the country decided that conservation of natural resources, including wildlife, was a good investment.

The place of the Federation's birth was Washington, D.C., at the first North American Wildlife Conference--a meeting called by President Franklin D. Roosevelt "to bring together all interested organizations, agencies, and individuals in behalf of restoration of land, water, forests, and wildlife resources." A resolution was adopted by unanimous vote to establish an organization which could do a systematic job of bringing the main conservation issues to elected public officials and to generate a unified program as well as unified pressure.

In its early years, the National Wildlife Federation functioned as what would today be called a lobbying organization. It pressured Congress in 1937, for instance, to pass the Pittman-Robertson Act, which has since produced more than $600 million for states to acquire and develop wildlife areas by taxing hunters' guns and amunition. Later, in order to maintain its tax-exempt status, NWF gave up lobbying and shifted its main emphasis to conservation education. Within the last year, the Federation has revitalized its lobbying program as a result of recent changes in the tax laws.

From its humble beginnings in 1976, the Federation has become the nation's largest non-profit, non-governmental conservation organization. It spends nearly $12 million a year on conservation education, research, environmental litigation, and liaison with government agencies. It publishes three popular magazines (NATIONAL WILDLIFE, INTERNATIONAL WILDLIFE, AND RANGER RICK'S NATURE MAGAZINE) and two biweekly newsletters, (Conservation News and Conservation Report), in addition to books and pamphlets that reach literally millions of readers.

The Federation works with schools by designing programs and providing audio-visual materials for nature and conservation studies. In addition to Wildlife Week--first proclaimed by President Roosevelt in 1938, and celebrated annually ever since--NWF sponsors conservation camps, regional conservation "summits," and national conferences to increase public awareness and support for the conservation cause.

The Federation's most important work takes place, of course, in its legal (or "Resources Defense") division which happens to be the one I work in. In addition to our litigation efforts--and each year we win several significant court decisions in environmental protection cases--we are continuously engaged in numerous administrative and less formal proceedings. We make a special effort to avoid litigation if there is any reasonable alternative available. Some of my own areas of activity and interest which relate to the concerns of this laboratory have to do with ocean dumping, ocean outfalls, wetlands, toxic chemicals, management of municipal sewage sludge, and the design of meaningful bioassays--for solid as well as liquid materials.

We sometimes get asked why an organization with "wildlife" in its name gets so involved in man's environmental problems. One of our early directors answered that question nearly 40 years ago. "Wildlife and human life are inseparable," he said. "It is necessary to conserve the one to save the other."

Moving to the topic of this symposium, it is obvious that research and regulation both play essential roles in the conservation of marine and fish and wildlife and generally in the protection of the marine environment. Regulation is needed to place legally enforceable limits on human activities which, while profitable to the few, are harmful to the many. Research is needed, in turn, to make the design and application of regulations equitable, non-arbitrary, and optimally effective.

Unfortunately, real life is seldom as simple in practice as it is supposed to be in theory. Certain things are just easier said than done.

For example, ecological systems are extraordinarily complex, particularly estuarine and marine systems. It is unrealistic to expect any amount of research to fully characterize and elucidate such systems. Also, given the endless variability in environmental conditions from place-to-place and from time-to-time, it is never possible to research all there is to know on the effects of oil spills or pesticide contamination, for example. What is true here and now will simply no longer be true there and then. Scientists have an obligation, which they sometimes neglect, to point out for the benefit of regulators the assumptions employed in the design of their experiments, the limitations inherent in the techniques employed, and the reservations and qualifications applicable to their findings and conclusions.

Regulators have a habit of asking scientists questions which are impossible to answer--and of expecting an answer immediately, if not sooner. Scientists, on the other hand, to the exasperation of lawyers and regulators--and often to the delight of those who are regulated--are seldom willing to

commit themselves to clear-cut, specific numerical limitations, guidelines, or standards. As one respected federal judge has pointed out, in the field of environmental protection one often lacks the luxury of having all of the answers--or sometimes of even knowing the right questions--before it becomes necessary to take action. Some risks are simply too great to justify the deferral of decisionmaking until the precise magnitude of the risk has been established and the costs of action have been shown to outweigh the benefits of inaction.

Scientists have a role, to be sure, in the assessment of risks, but the ultimate determination of how much risk is too much is a decision which can only be made through the political process. The success of that process in protecting human health and the environment will depend not only on the results of scientific research, but also on how clearly and effectively scientists are able and willing to communicate to those who write our laws and regulations. Of course, the lawmakers and regulators must also be willing to listen.

Let's take an example. Suppose it becomes necessary to determine the toxicity to non-target species of a new pesticide, which we'll call "Exterminal." How does one go about accomplishing this? If the pesticide is already on the market, one can do field studies of the actual environmental impacts of the stuff. Or even if it's not, one can do laboratory tests, such as bioassays, which can be acute or chronic, flow-through or static, and directed at individual species or at microcosmic reconstructions of ecological communities.

In each case, the completeness or universality of the research results is going to be limited by the conditions of the research. Were the organisms studied for effects, the most sensitive representatives of the ecosystems studied? If not, the toxicity of Exterminal will be understated in terms of the more sensitive species likely to come in contact with it. Were they tested for a sufficiently long period to allow subtle but important toxicity effects to be detected? If not, toxicity will again be understated in terms of longer-term effects. Were community and ecological effects examined to determine effects on overall biological systems? If not, individual species may fare well, but ecological relationships may be disrupted, and finely tuned ecological balances may collapse.

Again, unless the limitations of the test conditions are made clear, bureaucrats and polluters will equate the absence of observed effects in one situation with safety and acceptability in all situations. Or, as has been done by the drafters of EPA's ocean dumping regulations, it will be assumed that short-term bioassays which tell one something about a waste, can be used to the exclusion of everything else to tell one everything one needs to know about the waste.

Dr. Russell Peterson, then Chairman of the Council on Environmental Quality, made this point very well in a 1975 speech to a conference on oil pollution:

> Again and again in reading the scientific literature on the effects of oil spills, one encounters such statements as "There is no proof that such-and-such is the case," or "The data are inconclusive on this point," or "Further research is needed."
>
> To any decisionmaker, such statements are not only frustrating but useless. Many people in government and in industry must make decisions fast: they cannot indefinitely pace up and down the world's waiting room while a clutch of consulting physicians haggle their way toward an inconclusive prognosis. As Justice Oliver Wendell Holmes--an infantry commander during the Civil War--once expressed it, "There is nothing so salutary as commanding men under fire. You never are sure you are right--but you have to act."
>
> I sympathize with decisionmakers who seek definite answers from scientists and receive nothing but "maybe" in return. But I am also completely in sympathy with scientists who refuse to push inconclusive evidence to definite conclusions. Science has many laws, but those who pursue it take only one vow: assert only what you can prove. And often--particularly in the case of marine ecology-

"maybe" is the biggest truth you can assert. Such a response may seem to nonscientists a form of intellectual cowardice, a professional cop out....but such refusals to stretch ignorance into permissiveness are far from useless. In some cases, they have proved herioc.

Dr. Peterson gave as an example of this the refusal of Health, Education, and Welfare (HEW) official, Dr. Frances Kelsey, to approve the drug thalidomide for distribution as a tranquilizer in the United States, despite evidence indicating that the drug was harmless to laboratory animals. Dr. Kelsey's unwillingness to accept the lack of negative evidence as positive proof of the drug's safety was, or course, vindicated in a dramatic and tragic manner. In nations which had cleared the drug for distribution, deformed children were being born--without arms, without legs, their fingers and toes joined directly to their torsos or shoulders.

Dr. Peterson suggested that there was a lesson to be drawn from the thalidomide incident of broader applicability to environmental decisionmaking. He concluded that "given our partial knowledge of ecological relationships, we must be proportionately more vigilant about protecting them."

I think this illustrates the importance of not allowing risky activities to take place too readily. But it doesn't tell us where the balance is to be struck between risks and benefits.

In terms of the relationship between research and regulation, two things are apparent. First, research is essential in providing an adequate scientific rationale for regulations. Second, research will often--particularly in ecosystem research--not produce definitive results; so it will often be necessary for decisionmakers to promulgate regulations before sufficient scientific support is available.

In both cases, research of the sort being conducted at this Laboratory will aid immeasurably in enhancing the rationality of regulatory actions, by narrowing the number and magnitude of ecological imponderables which make clear-cut decisionmaking so difficult. In this regard, research on bioassay techniques for screening wastes before they are introduced into the environment, and on biomonitoring, for following the fate and effects of wastes, once they enter the environment, are particularly valuable as aids to regulatory decisionmaking.

This is not to say, however, that it is not necessary or desirable for EPA laboratories of this kind to conduct and sponsor a certain amount of "basic" as opposed to "applied" research. As someone who has been trained in science, I recognize that many of the greatest scientific advances came about as unintended side effects of other research, and that it is often not possible to plan research which will lead to a specific result. For this reason, I believe it is desirable for this Laboratory to maintain breadth as well as depth, and to resist the pressures and temptations which will invariably arise to do solely "issue"-oriented research.

I'd like to make one final point regarding the use of research in support of regulation: namely, the need for scientists to recognize that decisionmakers want more than "maybe" as an answer. If research results cannot support any less equivocal conclusions, it seems to me to be nevertheless necessary for EPA research scientists to be willing to give decisionmakers the benefit of their best professional judgment and expertise.

Obviously, it is neither possible or desirable to ban all beneficial activities simply because they pose some degree of risk of undesirable consequences.

My own view, which I've elaborated upon elsewhere, is that the best way to regulate risky activities is to prohibit absolutely those which threaten monumental adverse impacts, such as the extermination of whole species of living things or the production of human cancer, particularly where the activity involves a new assault on the environment, and to put the burden on the proponents of other risky activities to demonstrate that the risks presented are worth taking. No longer can we afford to consider the lack of negative evidence as tantamount to absolute proof.

Our legal system can no longer afford to operate under the old frontier ethic, which regarded resource exploitation and technology growth as the ultimate in desirable objectives. No longer can we presume that the risk of future injury is outweighed by the benefits of present technology, because some new technology can always be depended on to eliminate the risk. And no longer can we mismanage the land and pollute our streams and be able to count on there being more land to occupy and more streams to despoil.

Laboratories such as this and the scientists who work here can do much to ensure that the "risk" side of risk-benefit equations receives proper attention on the part of regulators. But if scientists are to truly aid the decisionmaking process and protect the environment against irreversible injury, it will be necessary for them to speak out and be willing to furnish decisionmakers with the benefit of their best scientific judgment, even before all the answers are in.

There is much we don't understand about the marine and estuaring environments and about the fate and effects of pollutants and other stresses in these environments. However, as Dr. Peterson has pointed out, we must firmly refuse to "stretch ignorance into permissiveness."

There is too much at stake to do otherwise.

THE SOCIAL RESPONSIBILITY OF THE SCIENTIST

Robert M. Shealy
Northwest Florida Sierra Club
Pensacola, Florida

The quality of life, the "standard of living," so highly prized by developed nations, is in very real danger of being irretrievably lowered. When our "honeymoon" with technology is finally over, and we look back on a trail cluttered with gadgets, we will realize that the best things in life were free, and were squandered thoughtlessly.

As a teacher, I operate on the assumption that an informed citizen will choose what is best for himself and his society. If this assumption is not valid, only heaven can save us.

To teach, we must know; and to know, we must cleverly and industriously extract secrets from a maze of natural phenomena. Research is the "life's blood" of real progress; not progress measured as GNP, or as technological "fixes," but as growth in the competence of the human community.

The sad fact, of course, is that in many areas the applications of our knowledge of pollution abatement are decades behind the times. This is a glaring social and political failing whose time for redemption is rapidly running out.

Environmental concerns cannot be localized, or even nationalized. They are, by their very nature, global. Secrecy in the name of security cannot be allowed to inhibit the free flow of vital research information throughout the world. When Lake Baikal suffers, we all lose; when the Chesapeake Bay succumbs, we're all affected. As we continue to overlook subtle effects, indirect effects, or delayed effects, our children will wonder, vaguely, why they inherited a dull and ravaged planet.

Research into the processes and problems of estuarine and marine environments is especially vital. We know that up to 85% of our atmospheric oxygen comes from the photosyntheses of marine phytoplankton; and that the biophysical qualities of the oceans determine many aspects of global climate. Now, this isn't some obscure, irrelevant fact. This determines who gluts and who starves!

As land-dwelling, air-breathing animals, we humans tend to apply our concepts of health and stress to all natural communities. This leads to a host of misconceptions in the nonscientific, decisionmaking public. Oxygen, for example, normally cannot exceed 10ppm in most natural waters. This is the only source of oxygen for fishes, crabs, shrimp, barnacles--the whole spectrum of aquatic life. As air-breathing animals, we take oxygen from an atmosphere that is 21% oxygen--that's 210,000 ppm! Also, we can depend on it; aquatic life, though, may lose their available oxygen in a matter of hours, due to a wide variety of pollutants, including heat.

Aquatic systems are not only quite different physically (and therefore biologically) from land-based systems, but are much more fragile. This fragility is carried a step further in marine ecosystems, because here, more than anywhere else, the physical environment is extemely stable. The life forms have evolved to take this stability for granted, and are therefore exquisitely delicate and dependent on a very narrow range of conditions. It is analogous to a thoroughbred race horse: finely bred for a single function, at the expense of toughness and adaptability.

The evolution of marine life spans over three billion years. With that much time, it's no wonder that interactions among these life forms have acquired a bewildering complexity, so that no component can

be modified without repercussions throughout the system. For example, one of the studies being conducted by this Lab has found that a widely used pesticide at miniscule concentrations (less than 1 ppb) does not kill or even obviously weaken shrimp, but modifies their behavior just enough to make them easy prey for small fish (1 ppb is one drop in 12,500 gallons!). Here, an otherwise imperceptible effect could effectively eliminate a major species from an entire estuary.

I am gratified, to say the least, that the research capacity of this Gulf Breeze Lab is being expanded. This Lab is addressing itself to some of the most acute environmental dangers we face.

Take the time (it would be well spent) to review the research of this lab over the past 10 years.

When I was invited to represent the Sierra Club at this dedication, I really wanted to decline, because I knew almost nothing about what the laboratory staff was doing. I spent a couple of hours in the library here and was surprised at the productivity of this Lab--and the research is consistently relevant, often crucial.

Before I visited the library I had made a working list of research approaches which, as an ecologist, I would like to see pursued. If I could have convinced anyone to listen, I expected to have most of my suggestions rejected as being "too far out," "unworkable," or "can't be done." Well, of 16 items on the list, 12 had been, or were being pursued.

The necessity of this type research keeping abreast of potential environmental dangers is obvious, but I think an additional step is required. We must start to reveal problems before they arise. To do this we have to study both by products and products of new industrial processes, as well as new toxins.

Incidents like the recent Kepone disaster in Virginia must be prevented--rectification is impossible. If legal loopholes prevent the EPA from doing its job, as happened in Virginia, let's iron them out. It's a lot easier than restoring an estuary or a seafood industry.

With the rush to exploit new energy resources comes pressures to relay or ignore environmental safeguards. (This ill-advised trend is derived, of course, from the popular misconception that a healthy environment is nice, but not necessary.) The spectre of widespread marine oil pollution looms closer with each "ping" of the gasoline pump. Information on the impact of this oil on marine organisms is urgently needed. I was happy to learn that this Lab is involved in studying several aspects of this problem.

If I were to criticize these scientists, it would be to urge them to be more active in getting this new knowledge into the proper hands. Not just the hands of superiors in the organization, but to hands of elected officials, and even us radical environmentalists! Don't let it get lost in some obscure report or in some anonymous avalanche of bureaucratic paper-work. In some cases, it would involve straining protocol a bit. Occasionally, and they know when this would apply, it is worth some "boat-rocking" to get things done.

In the name of "objectivity," scientists as a group too often divorce themselves from the implications of their research. In matters as important as the life or death of an estuary, though, responsibility does not end with the last experiment and the final report.

A major (and necessary) strength of the "pure scientist" is his rugged conservatism. He hesitates to conclude anything before all the variables are accounted for, and all the data are in. In an emergency, though, this attitude is often inappropriate, and we are forced to base our decisions on the best available information, on probability, and sometimes on an "old-fashioned," educated, "gut feeling." This uninvited burden of conscience is with us all, like it or not.

In today's world, the social responsibility of the scientist may well be one of the few remaining hopes of avoiding environmental Armageddon.

THE NEED FOR RESEARCH IN SUPPORTING ENVIRONMENTAL REGULATION

Robert V. Kriegel
Department of Environmental Regulation
Gulf Breeze, Florida

I appreciate the opportunity of participating in today's program. I feel the topic chosen is very timely and that our understanding of how to protect our marine environment will be enhanced by the interchange of ideas here today. My remarks will be fairly brief.

I think it will be useful to review the State's role in the regulation of activities affecting the marine environment. To change the format somewhat, I would like to give a quick summary of the history, organization, and responsibilities of the Department of Environmental Regulation (DER).

The Environmental Reorganization Act of 1975 created the DER by consolidating several, then existing, state agencies. The intent of the Act was to consolidate environmental permitting and enforcement activities under one agency to improve the administration and efficiency of the State's environmental protection program. As now structured, the Department consists of the air, water, solid waste, and noise functions of the Department of Pollution Control, the dredge and fill permitting and enforcement activities of the Internal Improvement Trust Fund, and the Drinking Water Supply Program from the Department of Health and Rehabilitative Services. The current staffing of 622 positions is actually less than that provided by the precursor agencies. The creation of DER was actually a realignment of existing functions, and not the creation of a new agency with new activities. And, the rationale for the realignment was to increase the efficiency and effectiveness of the people employed and the money spent in the State for environmental regulation.

Secretary Joseph Landers is the head of the Department and the Department consists of the Secretary's staff and three divisions: Administrative Services, Environmental Programs and Environmental Permitting.

The Division of Administrative Services provides administrative support and guidance to the operating divisions of the Department.

The Division of Environmental Programs handles the technical planning, grants assistance, and rule development functions of the Department. This Division, through the Secretary, recommends implementing standards for environmental regulation to the Environmental Regulation Commission.

It is worth noting that the Commission is a completely separate body of appointed lay citizens with responsibility for adopting environmental rules and hearing appeals of certain Department decisions.

The Division of Environmental Permitting has the critical function of overall supervision of the district offices and of department permitting. This Division is responsible for implementing the mandate of the Legislature, of making Department services readily available to the public through district centers, of providing one-stop application processing for most environmental permits and of delegating to local agencies as much responsibility as they can effectively administer.

The State has been divided into four districts. The districts have extensive permitting and enforcement authority and coordinate all activities with all divisions of the Department.

The Northwest District is responsible for the 16 counties from Escambia to Jefferson County. We have branch offices in Tallahassee and Panama City and the District Office is in Gulf Breeze.

I would divide the District's major regulatory responsibilities into three categories. The first would be Controlling Sources of Pollution by permitting the construction and operation of sources such as wastewater treatment plants, industrial plants, solid waste disposal facilities, air pollution sources, etc. The current State regulations require that any stationary installation reasonably expected to be a source of pollution, unless specifically exempted, shall not be operated, maintained, constructed, expanded, or modified without an appropriate and valid permit issued by the Department. A permit is issued by the Department only after it is assured that the installation will not cause pollution in violation of any of the provisions of Chapter 403, Florida Statutes, or the rules and regulations promulgated thereunder. The permit program includes compliance monitoring which is continuous throughout the life of the source to assure that permit conditions and discharge limitations are complied with by the permittee.

The next category would include controlling construction in the submerged and transitional areas associated with the State waters. This includes the issuance of most minor dredge and fill permits, the environmental reviews of larger dredge and fill applications and surveillance.

And lastly, we are responsible for the regulation of public drinking water supplies. This includes the issuance of construction permits and source review for public facilities. And I think the regulatory process has an acceptable record. Monitoring data indicate significant reductions in discharges of the various categories of pollutants in the past few years.

It is evident that the primary regulatory function of the Department is the application of environmental standards through the permit and enforcement program. It is essential that these standards are based on a sound, rational, and technically defensible basis. If our regulatory standards are defensible and necessary for the protection of the environment and public health, and are economically and technically attainable, the job of enforcing these standards is greatly simplified. But if the regulatory standards are arbitrary, ill-conceived, or easy to dispute technically, then the task of enforcement becomes far more difficult. The need for a dynamic program of scientific investigation and research that will produce a logical and technical basis for specific regulatory standards is obvious. It is also necessary to constantly update specific regulatory standards, to maintain currentness with the research findings and state-of-the-art technology. By doing so, we will minimize unnecessary economic impact and still maintain an effective level of environmental protection.

I feel much of the research necessary for standard setting for environmental regulation should be funded or accomplished at the Federal level. Lower levels of government simply do not have the financial resources necessary for an adequate research program. And, if lower levels of government tended to establish separate regulatory criteria, the results would be the creation of a maze of different standards for different locations--with obvious regulatory and economic repercussions. The Legislature of the State of Florida recognized this in the Environmental Reorganization Act in requiring the Department to conduct a study of the economic and environmental impact identifying the benefits and costs of any State standard stricter or more stringent than that set by any federal agency. However, there needs to be a continuing exchange of information and needs between the research leaders and the regulatory agencies responsible for the enforcement of standards to insure the appropriateness of ongoing research.

If we are to realize an effective program of protecting our marine environment through our regulation program then we must have public support for both the regulatory and supportive research programs. This support must be expressed in terms of adequate resources. And, in this country, we have a generally well-informed public that will provide the necessary support for most well-reasoned programs--providing, of course, it is affordable and reasonable.

It is often meaningful to review the technical basis of older programs to gain some perspective about the practicability and impact of applied research. The oldest environmental regulation program involved public drinking water. It dates back some 100-120 years ago when a cause-effect relationship was established between contaminated drinking water and human disease. The result was the inception of regulation of public water supply systems. Similarly, during the last 20-30 years, we have recognized that the gradual buildup of many substances in the water systems does pose a significant public health threat not directly addressed in many regulatory requirements. As a result, we now have the Federal Safe Drinking Water Act requiring a more comprehensive program of control and regulation. The point is that public awareness of the relationship between disease and the consumption of polluted water gave impetus to the initial drinking water programs; subsequent research and technical findings have resulted in another more comprehensive and demanding program. But, there still exists a great number of unanswered questions such as, what are the long-range effects of chlorine to the human body? What is the threshold of contaminants that the body can tolerate over the period of years? These are questions continued research must address.

I would like to outline very briefly just a few of the areas that I feel we need to direct research activities with respect to the marine environment.

One area of great concern today, with the pressure for controlling stormwater runoff from urban areas, is to specify the effects of this runoff on the marine environment. Massive quantities of various pollutants such as oxygen-demanding organics, fertilizers, oils and greases, pesticides, and so forth are simply shunted into the most available receiving waters. We simply don't know all of the effects of this type waste disposal, but we recognize its significance and adverse impact. What treatment or preventive mechanisms are available and realistically applicable? We need bioassays to identify levels and impacts of various pollutants in marine foodchains. In the Panhandle we are particularly concerned with papermill waste, systhetic fiber plants, domestic sewage, aircraft maintenance waste, and generally the petro-chemical waste products resulting from oil spills and transport of oil products along the Intracoastal Waterway. The disposal of sewage in coastal waters has been going on for many years but there is little quantification of the effects of this sewage in the biosystem.

Research should be directed at finding ways to accelerate the recovery of degraded bodies of water, such as local bays and bayous. Much of Escambia Bay, Pensacola Bay is covered with heavy sludge deposits that have accumulated over many, many years and serve as a blanket that prevents the re-establishment of the benthic community in many areas. This sludge may have value as a resource. We need to determine if there are economic and environmentally acceptable methods of retrieving and disposing of this material and if this would, in fact, be beneficial to the marine environment. Along these lines, one area of interest would be the establishment of economic criteria including environmental quality for such recovery effort.

We need in our dredge and fill program guidance in the form of quatification of the effects of dredge and fill activities. What sort of threshold, what standards should we impose on dredge and fill activities? How many treated pilings or marinas can a body of water assimulate? Are existing dredge and fill requirements adequate?

We have paid little attention to the impact of air pollution on the marine environment. But we recognize that aerial contaminants are removed by hydrologic cycles, and end up in our marine waters. What levels have impacts? I don't know but I am sure there are situations where air pollutants can and do have a significant influence on the viability of the marine environment.

There is no question that the research must play a vital part in supporting regulatory functions. The need for the research is to eliminate subjectiveness in standard setting, to establish standards based on an objective factual platform of knowledge resulting from good, well-founded scientific research. This approach I feel is necessary to maintain an effective program of environmental regulation with a minimum economic impact.

HOMOSAPIENS--BASIC RESEARCHER--ENDANGERED SPECIES

Alfred B. Chaet
The University of West Florida
Pensacola, Florida 32504

INTRODUCTION

I am most appreciative for the opportunity to participate in the dedication of this EPA Aquatic Toxicological Test Facility and to take part in this symposium on "Research and Regulations" as they pertain to protecting our marine environment. When searching my soul for a significant topic to discuss, it soon became obvious that I felt compelled to point out what I and others consider a most critical problem--a problem which I recognize to be of national and indeed of international concern--a problem whose solution, for the most part, is out of the hands of the administrator of this Laboratory, but may be the responsibility of some members of the audience attending today's dedication. It's a problem that is beginning to become ever increasingly obvious to a number of individuals. Hopefully some of you will eventually help legislate a solution before it is too late.

RELATIONSHIPS BETWEEN RESEARCH AND REGULATORY AGENCIES

Before detailing my concern, let me lead into the problem by first discussing the relationship between research on the one hand and regulatory agencies, such as those represented on a podium and in the audience of a typical dedication of this type.

First, I would be remiss if I did not dwell on the positive relationship that exists between this EPA Laboratory--this Sabine Island Facility--with the rest of the scientific community, particularly with the university I represent. The magnitude and meaningful cooperation between our two organizations--a government lab and a state university--continues to amaze me even after 11 years. Cooperation and joint programs seem to be EPA policy and/or Director's policy. This positive attitude either originates from Washington and is passed down to facilities such as this, and/or it originates from local situations and is transmitted to Washington. In any event, such marriages of convenience must have the encouragement of both Director and Washington.

Professional marriages are neither new nor limited to this example. I first became aware of and observed first hand another government/university marriage at Scripps Institute of Oceanography, University of California at San Diego. It was there, some 13 years ago, that I observed a very meaningful relationship between a government agency and a university. The Bureau of Commercial Fisheries constructed a multi-million dollar facility on state university property. Although this facility is used possbily, I suspect, 99% of the time by the federal government and its scientists, it was obvious that this close relationship was not only desirable for both institutions, the university and the federal government, but it was good for science in general. The intellectual and physical interchange between scientists of both institutions was evident. After having witnessed that exciting relaticnship in La Jolla, California, some of us worked towards a similar relationship between this EPA Laboratory (although it had a different name at that time) and The University of West Florida.

The relationship between The University of West Florida and this EPA Sabine Island Research Lab has continued to develop and grow to the point where there is a meaningful exchange of scientists in the areas of both research and teaching. In this marraige there is a sharing of facilities and equipment and the potential of a joint facility on university property.

Do regulatory agencies effect the researcher and his research? For whatever reason--whatever motives, regulatory agencies are in the position of preserving marine organisms and although their primary goal is not to preserve marine organisms for researchers to use as experimental tools, such is a side benefit--a spinoff from your regulatory agecies, for as you help preserve the environment you also preserve the necessary biological tools with which scientists work.

Regulatory agencies, when they protect organisms, are usually on the side of the scientists. This is illustrated by a sign posted on the California coast which read "Federal and State laws protect these tidepools. Removal of marine life living or dead, sand, rocks or shells is prohibited." One on the Florida coast reads "Picking of sea oats is unlawful." Although such laws forbid the removal of animals by tourists from tidepools and sea oats from sand dunes, one assumes scientists would be able to secure experimental material from these protected environments--regualtory agencies aiding the researcher.

THE PROBLEM--A MISPLACED PHILOSOPHY AND MISTRUST

Returning to the concern alluded to in my introductory remarks, the day is fast approaching when many of you, even in mission-oriented agencies, will express concern over the lack of basic research and the over-emphasis placed on applied or mission-oriented research.

As I pointed out my concern, I do so with knowledge that much of what I say can be construed as being self-serving--self-serving to those that I represent, to the type of institution, universities, where I have spent all of my working life, and to my basic interests and professional upbringing.

If one looks at the problem from a rather philosophical point of view, it boils down to the fact that too many of those responsible for authorizing and allocating funds, whether at the federal or state level, are overly concerned with the immediate problem and have given little attention to the long-term problem which we, as a nation, now face. Our country and those who have the awesome responsibility of setting national priorities have been overly concerned with what some classify as frivolous, unimportant or even ridiculous research or at least titles of research projects and they conclude that most basic research fits into that mold. Whatever the reasons behind this negative outlook towards basic research, this 10- to 15-year trend away from, and in some cases ignoring basic problems, is likely to cripple the scientific progress in this country in another 10 to 20 years. The regulatory agencies that many of you represent will possibly avoid enforcing existing regulations since you will be unable to support your logical conclusions with substantial or even adequate basic research data. You may realize that, should you follow your intuitions and bring an industrial polluter to court for defacing the marine environment, you find yourself on the losing end of a law suit because a well-advised attorney convinced the hearing officer that the true basic research to support your case was not available.

I submit that it is the Government's responsibility, both Federal and State, to protect this "national natural resource"--"the basic researcher." For without their laboratory labors--without the support to release their minds and talents to follow their intuitions, the information needed to solve our nation's problems and to attain our national goals is going to be hard to come by. Our country's present energy crisis is an example of a national goal which will be delayed for considerable time until adequate basic research is concluded.

Many, it seems, are turning to applied problems, and our Federal government has earmarked considerable funds to support these programs. As a result, even the most dedicated basic researcher, for whatever reasons, sooner or later seeks out and successfully receives funds for applied problems, rather than funds for basic research. Generally basic research support is so limited and the competition so keen that faculty avoid applying for the few available basic research dollars and go for the more prevalent dollar--the applied money--the training grant programs--the mission-oriented dollar. Unfortunately and with some justification, I might add, those who allocate Federal dollars and set national priorities feel that "relevance" is the "watch word"; "research applied to our national needs" is a "watch phrase"; and "exotic research titles" even if taken out of context to be "watched out for." Each concern--"relevance," "national

needs," and the fear of wasted tax dollars on "exotic research"--on the surface appear to be admirable goals, but from another vantage point, and at the expense of using over-used cliches, it is cutting off one's nose to spite one's face. We are missing the big picture and overlooking our nation's role as the international scientific leader; we have lost sight of the forest through the trees--of the marine environment, what it can do to solve some of our national problems through scientific studies of a particular toxicant, through individual pollutants, or this oil spillage, etc.

A tragic part of our present dilemma is that in another five to ten years, today's priorities and missions will change. If history repeats itself, the pendulum will return and we will secure adequate data through basic studies in solving our national problems. However, time is running out and we are rapidly losing our basic scientists--some to retirement, others who are moving away from the highly competitive basic research dollar to applied fields in search of funds. We will soon experience a rude awakening when we realize that our "national natural resource," the "basic researcher," particularly as he pertains to the marine environment, will be a thing of the past, and we will have to retrain out-dated individuals and beginning graduate students to fill the void that we unwillingly let occur.

THE FUTURE--CONTINUED SLIPAGE?

Thus, over the next five or ten years, I see this as a major issue, as a national setback, if not a catastrophe. As your agencies evolve, and it's almost a certainty that your agencies will by that time have new names, new structures, and new missions, you will be expected to seek solutions to new problems. If we can judge by the past, most of the new missions will, I suspect, be admirable, desirable, and needed. My point, however, is that as our present goals disappear and new ones take their place, the basic information we will need to achieve those new goals will not be there because too many of the present-day scientists are working on applied mission-oriented problems.

Let me mention a few examples to support my thesis and to illustrate why we should be concerned. With the shunting of Federal and State dollars into applied problems, there is little money available for the basic researcher. As a result, scientists have not been able to obtain grants which in part enable them to carry on research at institutions such as the Marine Biological Laboratory in Woods Hole, Massachusetts. To do so requires money for lab space, equipment, travel salaries for the investigator and promising young scientists, but since many faculty are less apt to secure this type of federal funding, they find themselves working on an applied problem not fully associated with the marine environment or on a training grant, etc. Basic researchers interested in life cycles find it difficult to secure grants for their research unless they are willing to work on a specific edible species. Yet, it is well documented that knowledge obtained through basic research will eventually help solve mariculture problems, uncover new sources of edible species, help solve problems of pollutants, toxins, and the like. Another trend of concern is that of losing national and indeed international facilities where basic research has been performed. Focus your attention to what has happened over the past five or six years to a marine station in Bimini. Here is, or was, a facility that allowed scientists to engage in basic research over most of the year but had to close its doors because of the lack of financial support--either direct support to the lab or indirect support from the grants awarded to basic researchers. I submit to you that the scientific community has lost a significant facility for the basic marine researcher. Other non-applied marine labs like those at Woods Hole are having considerable difficulty in staying afloat (no pun intended). They will continue to have difficulty unless federal priorities change; for without a change, some marine stations will be submerged and lost forever.

It appears that only a few government agencies have been able to carry on in-house basic research. A successful example of in-house basic research is that of the National Institutes of Health; however, they seem to be the exception. On a much smaller scale, I consider this Laboratory as another example of how a government facility can carry on meaningful basic research. But funds when set aside by agencies for basic research are still too compartmentalized and researchers are inclined to take their basic interests and artificially slant them to the mission of the agency rather than just work on the "physiology of marine organisms" and let one's interests and intuitions take him in the most profitable direction(s).

The goals of the National Science Foundation (NSF) have changed over the years and funds were needed and diverted to "research applied to our national needs," "science for the lay citizens," and "education and training of teachers." All programs are, in my opinion, significant, meaningful, and important, but the bottom line is considerably fewer dollars for NSF's basic research studies program.

For some years the Office of Naval Research has been a strong supporter of basic research, but over the past 10 years or so, for whatever reason, such funding was seriously curtailed.

The Sea Grant Program, which in some eyes began as a program to support basic research in the marine area, soon turned into a very applied program and is probably the most applied mission-oriented granting agency with which universities are involved.

However, the picture is not as black as I may have photographed it, for one can see a slight move in the pendulum. For example, President Carter's Administration will attempt to decrease in-house federal research and assign this research to universities--hopefully some of it in a less applied nature. There are other signs on the horizon that our Federal government is beginning to realize its oversight. A recent report of the Department of Defense (DOD) notes: "That the major strength of U.S. fundamental science resides in universities;" "That a re-engagement of this strength will be needed to assure a fundamental, long-range component of DOD research so as to balance the present emphasis on shorter-range, applied science;" "That DOD not demand that a sceintist demonstrate that his research project or program is relevant;" and finally, "That the issue of research relevance of a field of discipline." Another example, although it is minor in terms of dollars, is the NSF's new Basic Research Stability Grants Program (similar to NSF's old institutional grants), and although limited in dollars, it is a welcome trend.

In like manner, the National Institute of Environmental Health Sciences has embarked on a Marine-Freshwater Core Center Grant Program. Although funds will only support three to four universities this year, it too is a welcome beginning.

Ladies and gentlemen, I apologize for adding an air of gloom to this most joyous occasion, but felt compelled to alert you, that the research talent that can help solve your problems, is disappearing. Researchers have been engaging themselves in other areas--areas were funds are less competitive--training grants, mission-oriented studies, science of the citizens, science for minorities and female programs, and mainstreaming the handicapped, to name a few.

The problem is clear--our country's reservoir of basic scientific knowledge and more important of basic science researchers is disappearing. The solution is equally clear--adequate funds and opportunities, possibly through block grant funding, must be made available to universities so that their faculty and students will be encouraged to engage in basic research.

You, ladies and gentlemen, are concerned with protecting our national marine resources--and I submit to you that one such resource you must protect as best as you can is the endangered species--"Homosapiens--basic researcher"!!

DEDICATION PROGRAM

U. S. Environmental Protection Agency
Environmental Research Laboratory
Sabine Island
Gulf Breeze, Florida 32561
7 October 1977

SYMPOSIUM *8:30 am - 12:30 pm*

"PROTECTING THE MARINE ENVIRONMENT: RESEARCH AND REGULATION"

Chairman - Dr. Tudor Davies, Deputy Laboratory Director

Audubon Society - Dr. Peter Pritchard, Vice President, Science and Research, Florida
Conservation Foundation - Mr. John Clark, Senior Associate
Natural Resources Defense Council - Ms. Sarah Chasis, Staff Attorney
National Wildlife Federation - Dr. Kenneth Kamlet, Counsel
Sierra Club - Dr. Robert Shealy, President-Elect, Northwest Florida Chapter
State of Florida, Department of Environmental Regulation -
Dr. Robert Kriegel, District Manager
The University of West Florida - Dr. Al Chaet, Associate Vice President
for Research and Sponsored Programs

FISH FRY *12:30 pm - 2:00 pm*

DEDICATION CEREMONY ***2:00 pm - 3:00 pm***

Welcome - Dr. Thomas W. Duke, Laboratory Director
National Anthem - Naval Technical Training Center Volunteer Band, Corry Station
Invocation - Reverend Alvin Bullen, President, Interfaith Council
Remarks - Mr. John C. White, Regional Administrator, Region IV, EPA
Dr. Stephen Gage, Office of Research and Development, EPA
Dedicatory Addresses - Ms. Barbara Blum, Deputy Administrator, EPA
Honorable Bob Sikes, U.S. House of Representatives

TOUR OF FACILITIES *3:00 pm - 4:00 pm*

The new laboratory facilities will be open to the public on October 8,
from 9:00 am - 12:00 noon